DHP-Engineering ***Structural Engineering Consultants*** 25964 129th Place SE, Kent, WA 98030 Phone (253) 220-0848	***Memo #1*** ***From*** ***Bret Brasher***	☒ Memo ☐ Ph Log ☐ Confr. ☐ Info.	Page 1 of 24 **Distribution:**	

Date:	**4/12/2012**	Time:		**Dean Peyton**
Project:	**My Home Furniture**	Project No.	**12.006**	
Person:	**Merlin Smith**	Phone No.	**360-961-0990**	
Company:	**My Home Furniture**	Fax No.		
Subject:	**Totem Lake Mall Tenant Improvement – New Loading Dock**	Sent Via.....	Fax ☐ E-Mail ☒	Billing File ☐

Merlin,

As you have requested, DHP Engineering has reviewed (1) the new loading dock area; (2) the new 11' – 6" access opening in the north wall; and (3), relocation of existing door to adjacent place and installation of pre-engineered overhead bay door.

With regards to the new loading dock DHP has designed the retaining wall at the end with the upper loading dock and also the side condition without the surcharge load due loading equipment. See Details 1 and 2 for retaining wall configurations and calculations are included for city's reference.

Per discussion with you and city the wood sheathing has been exposed to show the typical nailing pattern at panel and field locations. The nailing at all areas was 12"to 13" o.c. and this wall would appear to be a non-structural wall due to nail spacing not being per typical wood shearwall nailing patterns. Above the new 11' – 6" opening is a 5-1/8" glulam beam spanning from an existing 7x7 steel column over to a seat on the exterior concrete wall. Therefore, no bearing load occurs on this wall. However, Contractor shall verify that the beam spanning over this wall is not retrofitted in any way as the The City stated some beams in this mall had some issues from previous snow storm damage. If beam doesn't appear to have been modified then loading condition is unchanged from original design intent of the structure and we don't have any further comments on this item. Contact our office for further review if beam varies from description listed above.

Concerning the door relocation item, contractor shall verify that the roof does not bear on the inset wall but bears on the same glulam beam line that aligns with the wall with the new 11' – 6"opening. If this is a bearing wall, contact our office for design of a beam and possible footing at this location. The new over head door is a pre-engineered system and shall be installed per the manufacturer's specifications.

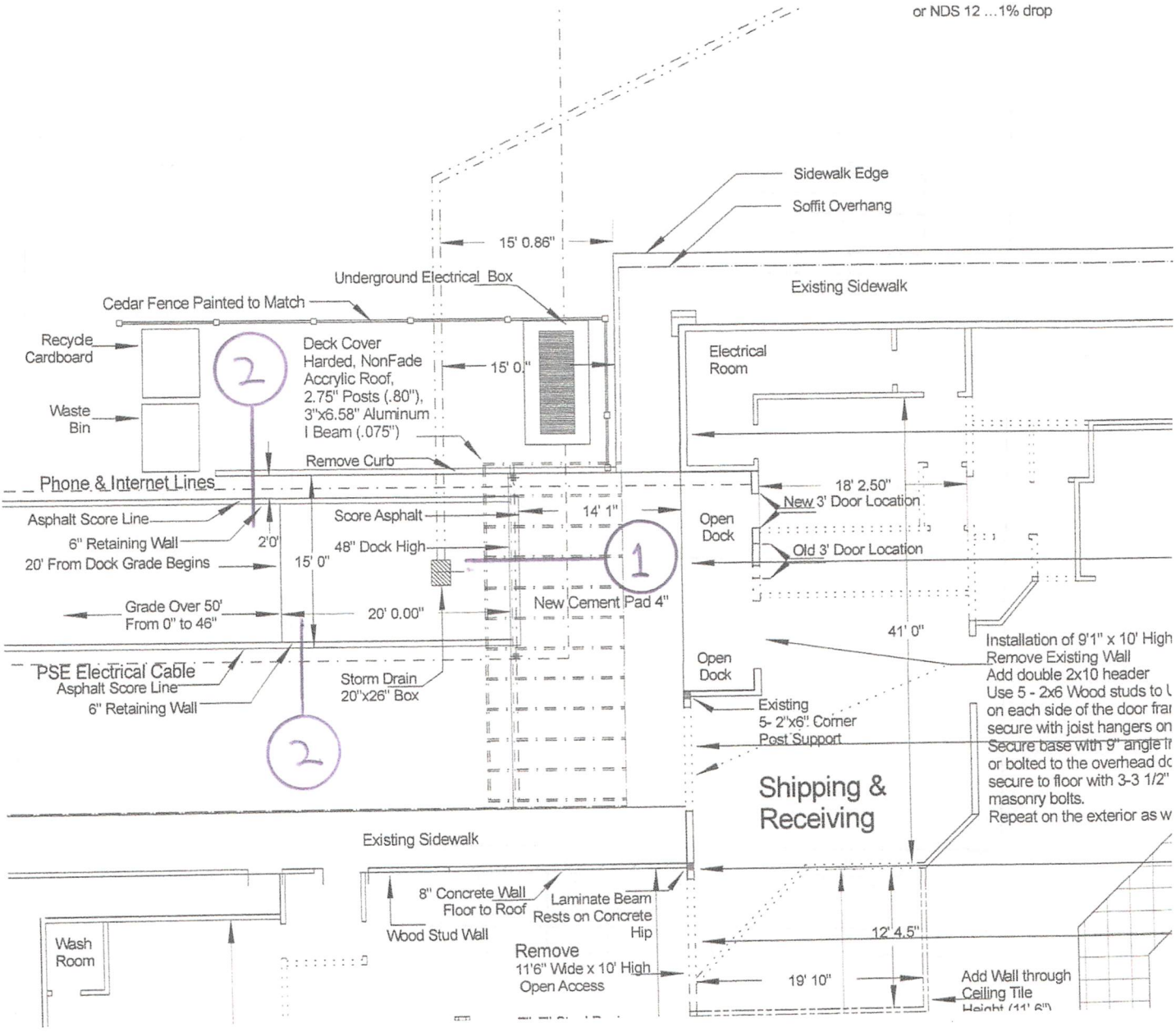
If you have any questions on the above items, feel free to contact us at 253-220-0484.

Sincerely,
DHP-Engineering
Structural Engineering PS

4/17/12

Bret I. R. Brasher, P. E.
Sr Project Engineer

Enclosure: Penthouse Partial Plan View My Home Furniture, Details 1 & 2 and Supporting Calculations



DOCK/RETAINING WALL
(NO SCALE)

DHP - Engineering *Structural Engineering PS*
25964 129TH PLACE SE KENT, WASHINGTON 98030 (253) 220-0484

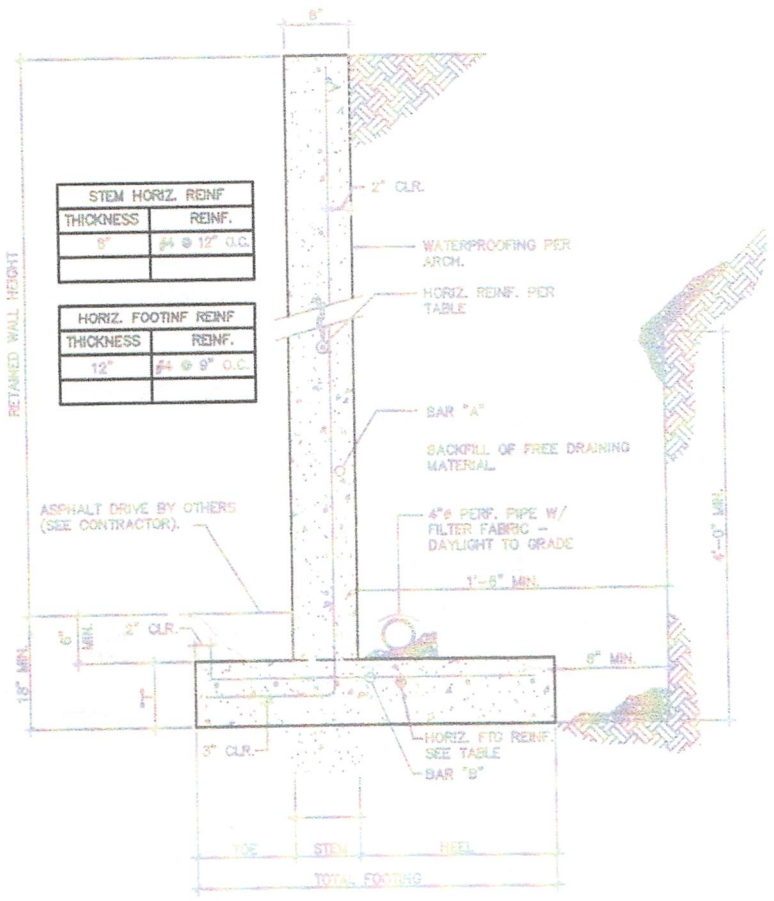
JOB NO : 12-006
ENGINEER : BIRB
DATE : 4-11-12

DESIGN PARAMETERS

MY HOME FURNITURE

1. SOIL BRG. = 1500 PSF
2. ACTIVE FLUID PRESSURE = 40 PCF
3. PASSIVE FLUID PRESSURE = 250 PCF
4. SOIL FRICTION COEF. = 0.4
5. SOIL UNIT WEIGHT = 120 PCF

NOTE: VALUES ARE ASSUMED PER IBC CH 18. OWNER/CONTRACTOR TO VERIFY.



STEM HORIZ. REINF	
THICKNESS	REINF.
8"	#4 @ 12" O.C.

HORIZ. FOOTING REINF	
THICKNESS	REINF.
12"	#4 @ 9" O.C.

NOTES:

1. PROVIDE CONTROL JOINTS PER DETAILS
2. PROVIDE CORNER STEEL @ FTG. CORNERS & INTERSECTIONS. USE @4x24"x24" ELBOW STEEL TO LAP HORIZ. REINF.
3. CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND HEIGHTS PRIOR TO CONSTRUCTION. NOTIFY ENGR./ARCH OF ANY DISCREPANCIES.
4. RETAINING WALL FOOTINGS MAY BE STEPPED PER DETAIL
5. REINFORCEMENT GRADES SHALL TYPICALLY BE GRADE 60
6. CONCRETE STRENGTH SHALL BE A MIN. OF 2500 PSI @ 28 DAYS STRENGTH OR AS PER TYPICAL STRUCTURAL NOTES
7. PROVIDE FREE DRAINING BACKFILL BEHIND WALL

FOOTING DIMENSIONS						BAR "A"			BAR "B"
RETAINED HEIGHT	TOE	STEM	HEEL	TOTAL	"T" THKNS	"H" HORIZ.	"V" VERT.	SIZE & SPACING	SIZE & SPACING
4'-0"	0'-8"	8"	1'-6"	2'-10"	12"	8"	FULL HT.	#4 @ 18" O.C.	#5 @ 9" O.C.

PAD RETAINING WALL AND REINFORCEMENT SCHEDULE

DHP - Engineering *Structural Engineering PS*
25964 129TH PLACE SE KENT, WASHINGTON 98030 (253) 220-0484

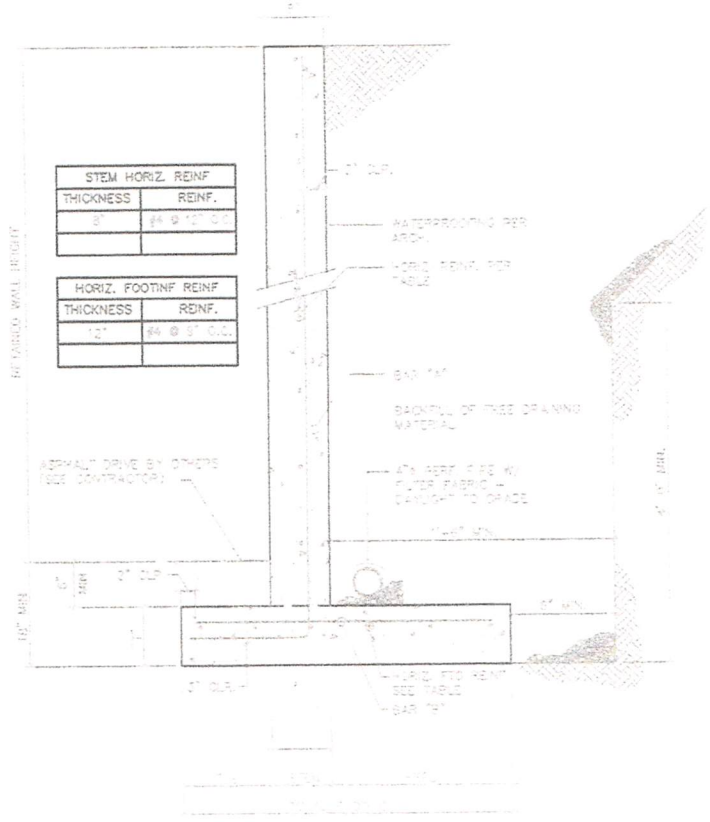
JOB NO : 12-606
ENGINEER : DIRB
DATE : 4-11-12

DESIGN PARAMETERS

MY HOME FURNITURE

1. SOIL ERG. = 1600 PCF
2. ACTIVE FLUID PRESSURE = 40 PCF
3. PASSIVE FLUID PRESSURE = 250 PCF
4. SOIL FRICTION COEF. = 0.4
5. SOIL UNIT WEIGHT = 120 PCF

NOTE: VALUES ARE ASSUMED PER IBC CH 18 OWNER/CONTRACTOR TO VERIFY.



STEM HORIZ. REINF	
THICKNESS	REINF.
8"	#4 @ 12" O.C.

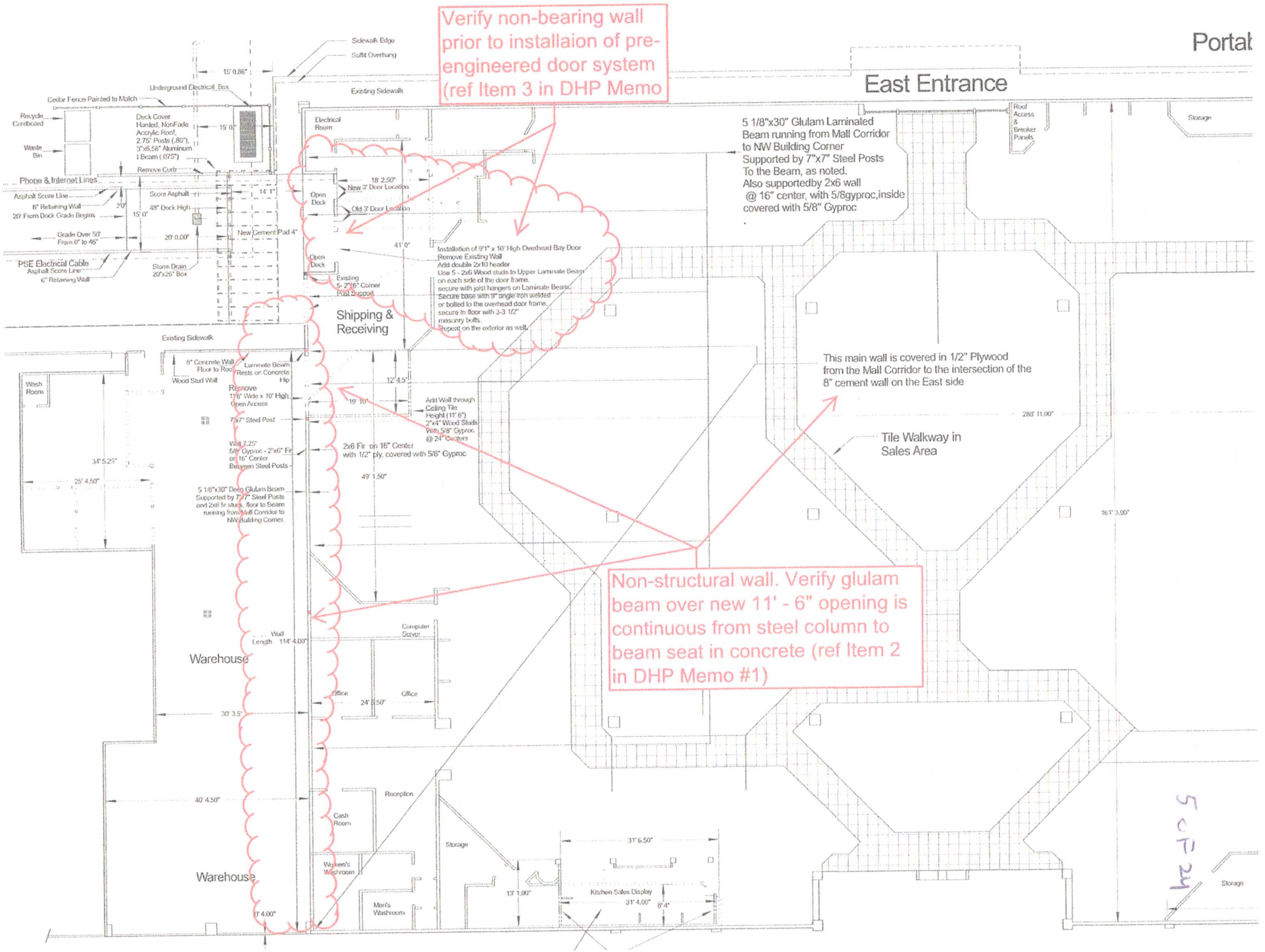
HORIZ. FOOTINF REINF	
THICKNESS	REINF.
12"	#4 @ 9" O.C.

NOTES:

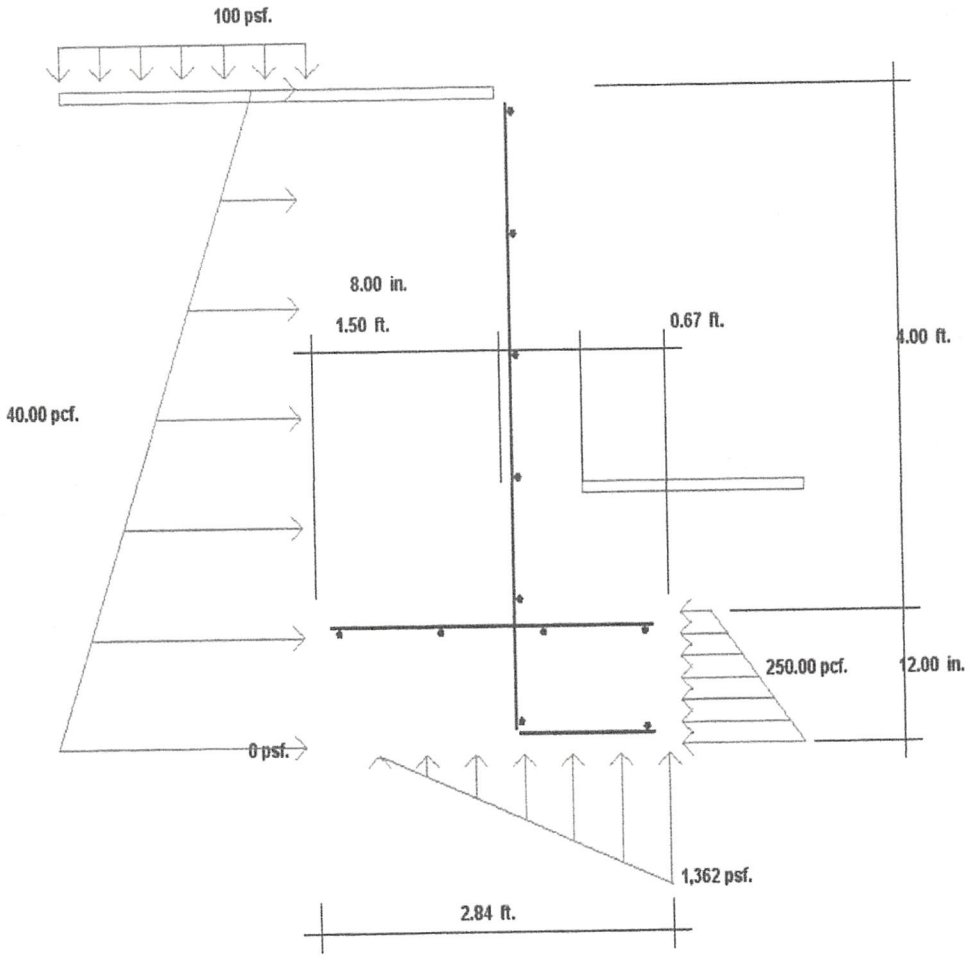
1. PROVIDE CONTROL JOINTS PER DETAILS
2. PROVIDE CORNER STEEL @ FTG. CORNERS & INTERSECTIONS USE #4x24"x24" ELBOW STEEL TO LAP HORIZ. REINF.
3. CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND HEIGHTS PRIOR TO CONSTRUCTION, NOTIFY ENGR./ARCH OF ANY DISCREPANCIES.
4. RETAINING WALL FOOTINGS MAY BE STEPPED PER DETAIL
5. REINFORCEMENT GRADES SHALL TYPICALLY BE GRADE 60
6. CONCRETE STRENGTH SHALL BE A MIN. OF 2500 PSI @ 28 DAYS STRENGTH OR AS PER TYPICAL STRUCTURAL NOTES
7. PROVIDE FREE DRAINING BACKFILL BEHIND WALL.

FOOTING DIMENSIONS						BAR "A"			BAR "B"
RETAINED HEIGHT	TOE	STEM	HEEL	TOTAL	"T" THKNS	"H" HORIZ.	"V" VERT.	SIZE & SPACING	SIZE & SPACING
4'-0"	0'-8"	8"	1'-0"	2'-4"	12"	8"	FULL HT.	#4 @ 18" O.C.	#5 @ 9" O.C.

2 SIDE RETAINING WALL AND REINFORCEMENT SCHEDULE


Verify non-bearing wall prior to installaion of pre-engineered door system (ref Item 3 in DHP Memo
Portal
East Entrance
5 1/8"x30" Glulam Laminated Beam running from Mall Corridor to NW Building Corner Supported by 7"x7" Steel Posts To the Beam, as noted. Also supportedby 2x6 wall @ 16" center, with 5/8gyproc,inside covered with 5/8" Gyproc
Installation of 9'1" x 10' High Overhead Bay Door
Remove Existing Wall
Add double 2x10 header
Use 5 - 2x6 Wood studs to Upper Laminate Beam on each side of the door frame.
secure with joist hangers on Laminate Beam.
Secure base with 9" angle iron welded or bolted to the overhead door frame.
secure to floor with 3-3 1/2" masonry bolts.
Repeat on the exterior as well.
Shipping & Receiving
This main wall is covered in 1/2" Plywood from the Mall Corridor to the intersection of the 8" cement wall on the East side
Tile Walkway in Sales Area
Non-structural wall. Verify glulam beam over new 11' - 6" opening is continuous from steel column to beam seat in concrete (ref Item 2 in DHP Memo #1)
Warehouse
Warehouse
Sidewalk Edge
Soffit Overhang
Existing Sidewalk
Underground Electrical Box
Cedar Fence Painted to Match
Recycle Cardboard
Waste Bin
Deck Cover Handed, Non-Fade Acrylic Roof, 2.75" Posts (.80"), 3"x6.58" Aluminum I Beam (.075")
Remove Curb
Phone & Internet Lines
Asphalt Score Line
6" Retaining Wall
20' From Dock Grade Begins
Grade Over 50' From 0" to 46"
PSE Electrical Cable
Score Asphalt
48" Dock High
New Cement Pad 4"
Storm Drain 20"x26" Box
Electrical Room
Open Dock
New 3' Door Location
Old 3' Door Location
Existing 5- 2"x6" Corner Post Support
Roof Access & Breaker Panels
Storage
Wash Room
6" Concrete Wall Floor to Roof
Wood Stud Wall
Laminate Beam Rests on Concrete Hip
Remove 11'6" Wide x 10' High Open Access
7"x7" Steel Post
Wall 7.25" 5/8" Gyproc - 2"x6" Fir on 16" Center Between Steel Posts
5 1/8"x30" Deep Glulam Beam Supported by 7"x7" Steel Posts and 2x8 fir studs, floor to beam running from Mall Corridor to NW Building Corner.
Add Wall through Ceiling Tile Height (11' 6") 2"x4" Wood Studs With 5/8" Gyproc @ 24" Centers
2x6 Fir on 16" Center with 1/2" ply, covered with 5/8" Gyproc
Wall Length 114' 4.00"
Computer Server
Office
Office
Reception
Cash Room
Storage
Women's Washroom
Men's Washroom
Kitchen Sales Display
Storage
5 of 24

END CEMENT PAD OR DECK SLAB



QuickWall 7.0 - RETAINING WALL ANALYSIS AND DESIGN

Job ID :
Job Description : Designed By :

FOOTING DESIGN METHOD: Ultimate Strength ACI 318-08
STEM DESIGN METHOD : Ultimate Strength ACI 318-08 (Concrete)
WALL TYPE : Cantilever Retaining Wall

RETAINING WALL DIMENSIONS:

Wall Stem Height		=	4.00 ft.		
Stem Thickness @ Top		=	8.00 in.		
Stem Thickness @ Bottom		=	8.00 in.		
Footing Thickness		=	12.00 in.		
Heel Width	Min.	=	1.00 ft.	Design Heel Width =	1.50 ft.
	Max.	=	4.00 ft.		
Toe Width	Min.	=	0.67 ft.	Design Toe Width =	0.67 ft.
	Max.	=	1.00 ft.		
Footing Key Depth		=	0.00 ft.	Design Key Depth =	0.00 ft.
Footing Key Width		=	0.00 ft.	Design Key Width =	0.00 ft.
BackFill Slope (Vert/Horiz)		=	0.00 :12		

RETAINING WALL LOADS:

Horizontal Equivalent Fluid Pressure	=	40.00 pcf.	(Load Case = Soil)
Backfill Height	=	4.00 ft.	
Equivalent Fluid Pressure Angle	=	0.00 deg.	
Vertical Surcharge on Backfill	=	100 psf.	(Load Case = Soil)
Horizontal Surcharge	=	0 psf.	(Load Case = Live)
Vertical Surcharge on Toe	=	0 psf.	(Load Case = Soil)
Wind Load on Fence	=	0 psf.	(Load Case = Wind)
Fence Height	=	0.00 ft.	

Line Ld. No.	Type (H or V)	Magnitude (plf)	Dist. (x) (ft.)	Load Case
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Notes: 1. "H" = Horizontal loads. "V" = Vertical loads.
2. Vertical loads are positive down.

ULTIMATE STRENGTH LOAD COMBINATIONS (Concrete Design):

1.4D + 1.4H
1.2D + 1.6L + 1.6H + 0.5R
1.2D + 1.6R + 1.0L
1.2D + 1.6R + 0.8W
1.2D + 1.6W + 1.0L + 0.5R
1.2D + 1.0E + 1.0L + 0.2R
0.9D + 1.6W + 1.6H
0.9D + 1.0E + 1.6H

WORKING STRESS LOAD COMBINATIONS (Stability Checks and Masonry Design):

D + L + R + H
D + L + W + H
D + L + W + 0.5R + H
D + L + R + 0.5W + H
D + L + R + E/1.4 + H
D + E/1.4 + H

RETAINING WALL RESISTING FORCES:

Allowable Soil Pressure	= 1,500	psf.
Passive Equivalent Fluid Press.	= 250.00	pcf.
Passive Soil Height	= 1.00	ft.
Coefficient of Friction	= 0.40	
Cohesion	= 0	psf.

Use Vertical Surcharge as Resisting Wt.? = No

Overturning Safety Factor	= 1.50
Sliding Safety Factor	= 1.50
Limit Reaction to Mid 1/3?	= No

MATERIAL DATA:

Concrete Strength, f'c	= 2.50	ksi.
Steel Yield Strength, Fy	= 60.00	ksi.
Concrete Unit Weight	= 145.00	pcf.
Soil Unit Weight	= 120.00	pcf.
Fence Weight	= 10.00	psf.

REINFORCING STEEL DATA:

Concrete cover to center of steel:

Wall Inside Face	= 2.50	in.
Footing Heel (Top Face)	= 2.50	in.
Footing Toe (Bottom Face)	= 3.50	in.

Minimum Ratios for Shrinkage and Temperature Reinf:

Vertical Stem Reinf.	= 0.0012
Horizontal Stem Reinf.	= 0.0020
Footing Reinforcement	= 0.0018

****
SUMMARY OF RESULTS
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DIMENSIONS:

Stem Height	= 4.00 ft.	Heel Length	= 1.50 ft.
Stem Thick. @ Top	= 8.00 in.	Toe Length	= 0.67 ft.
Stem Thick. @ Base	= 8.00 in.	Total Ftg. Width, B	= 2.84 ft.
Footing Thickness	= 12.00 in.	Key Depth	= 0.00 ft.
		Key Width	= 0.00 ft.

ANALYSIS RESULTS:

Max Brg Press. @ Toe	= 1,362 psf.	Sliding Force	= 667 Lb
@ Heel	= 0 psf.	Resisting Force	= 1,014 Lb
Allowable Brg. Press.	= 1,500 psf.	F.O.S.	= 1.52
Resultant Loc From C.L.	= 0.64 ft.	Overturn. Moment	= 1,250 ft-lb
Kern Point Loc., B/6	= 0.47 ft.	Resisting Moment	= 2,501 ft-lb
Limit Resultant To Mid 1/3?	= No	F.O.S.	= 2.00

DESIGN RESULTS: Design Method, Stem: USD, ACI 318-08 (Concrete)
Ftg.: Ultimate Strength ACI 318-08

	d (in.)	Mu (ft-k)	Vu (kip)	Phi Vn (kip)	As Flex. (in^2)	As Min. (in^2)	As T+S (in^2)
Stem :	5.50	1.11	0.73	4.95	0.045	0.060	0.134
Toe :	8.50	0.66	0.00	7.65	0.017	0.023	0.259
Heel :	9.50	0.84	1.08	8.55	0.020	0.026	0.259
Key :	0.00	0.00	0.00	0.00	0.000	0.000	0.000

Notes: 1. Stem moments are positive if they cause tension on the soil face. Negative if they cause tension on the outside face. Stem shear is positive to the left as measured on a section cut below the top of wall.

2. Heel moments are positive if they cause tension in the top of the footing. Heel shear is positive up as measured on a section cut to the right of the end of the heel.

3. Toe moments are positive if they cause tension in the bottom of the footing. Toe shear is positive up as measured on a section cut to the left of the end of the toe.

****
STABILITY ANALYSIS REPORT
****

Stability Analysis: Governing Combination = D + L + R + H

RESISTING FORCES				OVERTURNING FORCES			
Element	Weight	x Arm	= Moment	Element	Force	x Arm	= Moment
Soil	800		1,529	R at Top			
Ftg.	411	1.42	583	R at Bot.			
Stem	387	1.00	388	Horiz. EFP	500	1.67	833
Vert Sur				Vert Sur	167	2.50	417
Vert EFP				Horiz Sur			
Toe Sur.				Wind			
Fence Wt.				Horiz line			
V. line				Vert. line			
Sum WT =	1,598	MR =	2,501	Sum F =	667	MOT =	1,250

Friction Force	=	639 Lb	F.O.S. Sliding	= RF / F =	1.52
Passive Pressure	=	375 Lb	F.O.S. Overturn.	= MR / MOT =	2.00
Cohesion	=	0 Lb			
Resist. Force, Sum RF =		1,014 Lb	Coef. Vert. Surcharge or Line Load to Horiz. = EFP / Soil Dens. =		0.333

Resultant Loc From Toe,	X = (MR - MOT) / Sum WT	=	0.78 ft.
Eccentricity From Ftg. C.L.,	e = (B / 2) - X	=	0.64 ft.
Soil Pressure @ Toe	= (2 * WT) / (3 * X)	=	1,362 psf.
Soil Pressure @ Heel	=	=	0 psf.

****
DETAILED DESIGN REPORT
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STEM DESIGN: Steel Design Comb = 1.2D + 1.6L + 1.6H + 0.5R
Shr Strength @ Base, Phi Vn = 4.95 kip

Dist From Top (ft)	d (in.)	Mu (ft-k)	Vu (kip)	As Flex. (in^2)	As Min. (in^2)	As T+S (in^2)	As Reqd (in^2)	Comb
0.40	5.50	0.00	0.03	0.000	0.000	0.115	0.115	2
0.80	5.50	0.02	0.06	0.001	0.001	0.115	0.115	2
1.20	5.50	0.06	0.11	0.002	0.003	0.115	0.115	2
1.60	5.50	0.11	0.17	0.005	0.006	0.115	0.115	2
2.00	5.50	0.19	0.23	0.008	0.010	0.115	0.115	2
2.40	5.50	0.30	0.31	0.012	0.016	0.115	0.115	2
2.80	5.50	0.44	0.40	0.018	0.024	0.115	0.115	2
3.20	5.50	0.62	0.50	0.025	0.034	0.115	0.115	2
3.60	5.50	0.84	0.61	0.034	0.046	0.115	0.115	2
4.00	5.50	1.11	0.73	0.045	0.060	0.134	0.134	2

Vertical Stem Reinforcement:
Shear-Friction Steel Added at Stem Base (ACI 08 11.6), Avf = 0.019 in^2
Available Length for Hook Embedment into Footing = 9.00 in.
Available Length for Straight Embedment into Stem = 46.00 in.

#4 @ 18" o/c

	Development Length Straight (in.)	Hook (in.)	Percent Develop.	Spac. (in.)	50% Cut Off (in.)
#4	14.40	8.40	100.00	17.87	48.00
#5	18.00	10.50	85.71	18.00	48.00
#6	21.60	12.60	71.43	18.00	48.00
#7	31.50	14.70	61.22	18.00	48.00
#8	36.00	16.80	53.57	18.00	48.00
#9	45.81	18.95	47.49	18.00	48.00
#10	58.06	21.34	42.18	18.00	48.00
#11	71.57	23.69	37.99	18.00	48.00

Horizontal Stem Reinforcement:
Area of steel for Shrinkage and Temp. Reinforcement = 0.192 in^2

#4 @ 12" o/c

	-----Spacing, in.----- I.F. Only	EA. Face	------Total Bars------ I.F. Only	EA. Face
#4	12.50	18.00	5.00	4.00
#5	18.00	18.00	4.00	4.00
#6	18.00	18.00	4.00	4.00
#7	18.00	18.00	4.00	4.00
#8	18.00	18.00	4.00	4.00
#9	18.00	18.00	4.00	4.00
#10	18.00	18.00	4.00	4.00
#11	18.00	18.00	4.00	4.00

TOE DESIGN:

* Steel Design Comb. = 0.9D + 1.6W + 1.6H
* Thickness Design Comb. = 1.4D + 1.4H
* Available Length for Hook Embedment into Stem = 6.00 in.
* Available Length for Straight Embed. into Toe = 6.04 in.

d (in.)	Mu (ft-k)	Vu (kip)	Phi Vn (kip)	As Flex. (in^2)	As Min. (in^2)	As T+S (in^2)	As Req'd (in^2)
8.50	0.66	0.00	7.65	0.017	0.023	0.259	0.259

	Development Length Straight (in.)	Hook (in.)	Percent Develop.	Spac. (in.)
#4	14.40	8.40	41.94	3.88
#5	18.00	10.50	33.56	4.82
#6	21.60	12.60	27.96	5.70
#7	31.50	14.70	19.17	5.33
#8	36.00	16.80	16.78	6.14
#9	40.61	18.95	14.87	6.89
#10	45.72	21.34	13.21	7.77
#11	51.12	23.69	11.81	8.53

HEEL DESIGN:

* Steel Design Comb. = 1.4D + 1.4H
* Thickness Design Comb. = 1.2D + 1.6L + 1.6H + 0.5R
* Available Length for Straight Embedment into Toe = 14.04 in.
* Available Length for Straight Embedment into Heel = 16.00 in.

d (in.)	Mu (ft-k)	Vu (kip)	Phi Vn (kip)	As Flex. (in^2)	As Min. (in^2)	As T+S (in^2)	As Req'd (in^2)
9.50	0.84	1.08	8.55	0.020	0.026	0.259	0.259

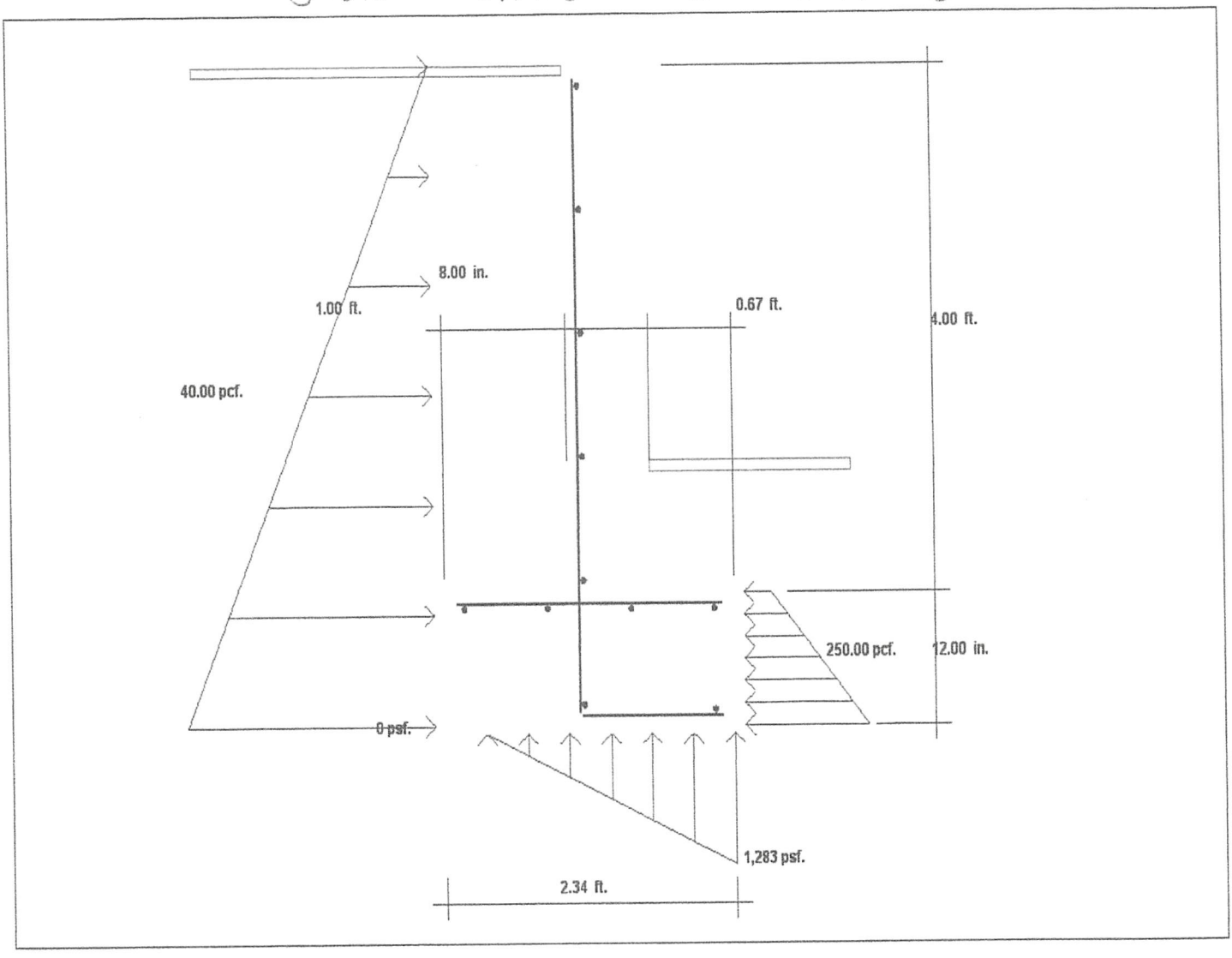
	Development Length Straight (in.)	Hook (in.)	Percent Develop.	Spac. (in.)
#4	14.40	8.40	97.50	9.03
#5	18.00	10.50	78.00	11.19
#6	21.60	12.60	65.00	13.24
#7	31.50	14.70	44.57	12.38
#8	36.00	16.80	39.00	14.26
#9	45.81	18.95	30.65	14.19
#10	58.06	21.34	24.18	14.22
#11	71.57	23.69	19.62	14.17

#5 @ 9" d/c

LONGITUDINAL FOOTING REINFORCEMENT (TEMP & SHRINK ONLY):

	Spacing (in.)
#4	9.26
#5	14.35
#6	20.37
#7	27.78
#8	36.57
#9	46.30
#10	58.80
#11	72.22

SIDE WALLS w/o DECK/PAD ABOVE



QuickWall 7.0 - RETAINING WALL ANALYSIS AND DESIGN

Job ID :
Job Description : Designed By :

FOOTING DESIGN METHOD: Ultimate Strength ACI 318-08
STEM DESIGN METHOD : Ultimate Strength ACI 318-08 (Concrete)
WALL TYPE : Cantilever Retaining Wall

RETAINING WALL DIMENSIONS:

Wall Stem Height		= 4.00 ft.			
Stem Thickness @ Top		= 8.00 in.			
Stem Thickness @ Bottom		= 8.00 in.			
Footing Thickness		= 12.00 in.			
Heel Width	Min.	= 1.00 ft.	Design Heel Width	=	1.00 ft.
	Max.	= 4.00 ft.			
Toe Width	Min.	= 0.67 ft.	Design Toe Width	=	0.67 ft.
	Max.	= 1.00 ft.			
Footing Key Depth		= 0.00 ft.	Design Key Depth	=	0.00 ft.
Footing Key Width		= 0.00 ft.	Design Key Width	=	0.00 ft.
BackFill Slope (Vert/Horiz)		= 0.00 :12			

RETAINING WALL LOADS:

Horizontal Equivalent Fluid Pressure	= 40.00 pcf.	(Load Case = Soil)
Backfill Height	= 4.00 ft.	
Equivalent Fluid Pressure Angle	= 0.00 deg.	
Vertical Surcharge on Backfill	= 0 psf.	(Load Case = Soil)
Horizontal Surcharge	= 0 psf.	(Load Case = Live)
Vertical Surcharge on Toe	= 0 psf.	(Load Case = Soil)
Wind Load on Fence	= 0 psf.	(Load Case = Wind)
Fence Height	= 0.00 ft.	

Line Ld. No.	Type (H or V)	Magnitude (plf)	Dist. (x) (ft.)	Load Case
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Notes: 1. "H" = Horizontal loads. "V" = Vertical loads.
2. Vertical loads are positive down.

ULTIMATE STRENGTH LOAD COMBINATIONS (Concrete Design):

1.4D + 1.4H
1.2D + 1.6L + 1.6H + 0.5R
1.2D + 1.6R + 1.0L
1.2D + 1.6R + 0.8W
1.2D + 1.6W + 1.0L + 0.5R
1.2D + 1.0E + 1.0L + 0.2R
0.9D + 1.6W + 1.6H
0.9D + 1.0E + 1.6H

WORKING STRESS LOAD COMBINATIONS (Stability Checks and Masonry Design):

D + L + R + H
D + L + W + H
D + L + W + 0.5R + H
D + L + R + 0.5W + H
D + L + R + E/1.4 + H
D + E/1.4 + H

RETAINING WALL RESISTING FORCES:

Allowable Soil Pressure	= 1,500	psf.
Passive Equivalent Fluid Press.	= 250.00	pcf.
Passive Soil Height	= 1.00	ft.
Coefficient of Friction	= 0.40	
Cohesion	= 0	psf.

Use Vertical Surcharge as Resisting Wt.? = No

Overturning Safety Factor	= 1.50	
Sliding Safety Factor	= 1.50	
Limit Reaction to Mid 1/3?	= No	

MATERIAL DATA:

Concrete Strength, f'c	= 2.50	ksi.
Steel Yield Strength, Fy	= 60.00	ksi.
Concrete Unit Weight	= 145.00	pcf.
Soil Unit Weight	= 120.00	pcf.
Fence Weight	= 10.00	psf.

REINFORCING STEEL DATA:

Concrete cover to center of steel:

Wall Inside Face	= 2.50	in.
Footing Heel (Top Face)	= 2.50	in.
Footing Toe (Bottom Face)	= 3.50	in.

Minimum Ratios for Shrinkage and Temperature Reinf:

Vertical Stem Reinf.	= 0.0012
Horizontal Stem Reinf.	= 0.0020
Footing Reinforcement	= 0.0018

****
SUMMARY OF RESULTS
****

DIMENSIONS:

Stem Height	= 4.00 ft.	Heel Length	= 1.00 ft.
Stem Thick. @ Top	= 8.00 in.	Toe Length	= 0.67 ft.
Stem Thick. @ Base	= 8.00 in.	Total Ftg. Width, B	= 2.34 ft.
Footing Thickness	= 12.00 in.	Key Depth	= 0.00 ft.
		Key Width	= 0.00 ft.

ANALYSIS RESULTS:

Max Brg Press. @ Toe	= 1,283 psf.	Sliding Force	= 500 Lb
@ Heel	= 0 psf.	Resisting Force	= 889 Lb
Allowable Brg. Press.	= 1,500 psf.	F.O.S.	= 1.78
Resultant Loc From C.L.	= 0.50 ft.	Overturn. Moment	= 833 ft-lb
Kern Point Loc., B/6	= 0.39 ft.	Resisting Moment	= 1,692 ft-lb
Limit Resultant To Mid 1/3?	= No	F.O.S.	= 2.03

DESIGN RESULTS: Design Method, Stem: USD, ACI 318-08 (Concrete)
Ftg.: Ultimate Strength ACI 318-08

	d (in.)	Mu (ft-k)	Vu (kip)	Phi Vn (kip)	As Flex. (in^2)	As Min. (in^2)	As T+S (in^2)
Stem :	5.50	0.68	0.51	4.95	0.028	0.037	0.126
Toe :	8.50	0.53	0.00	7.65	0.014	0.019	0.259
Heel :	9.50	0.39	0.75	8.55	0.009	0.012	0.259
Key :	0.00	0.00	0.00	0.00	0.000	0.000	0.000

Notes: 1. Stem moments are positive if they cause tension on the soil face. Negative if they cause tension on the outside face. Stem shear is positive to the left as measured on a section cut below the top of wall.

2. Heel moments are positive if they cause tension in the top of the footing. Heel shear is positive up as measured on a section cut to the right of the end of the heel.

3. Toe moments are positive if they cause tension in the bottom of the footing. Toe shear is positive up as measured on a section cut to the left of the end of the toe.

****
STABILITY ANALYSIS REPORT
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Stability Analysis: Governing Combination = D + L + R + H

RESISTING FORCES				OVERTURNING FORCES			
Element	Weight	x Arm	= Moment	Element	Force	x Arm	= Moment
Soil	560		909	R at Top			
Ftg.	339	1.17	396	R at Bot.			
Stem	387	1.00	388	Horiz. EFP	500	1.67	833
Vert Sur				Vert Sur			
Vert EFP				Horiz Sur			
Toe Sur.				Wind			
Fence Wt.				Horiz line			
V. line				Vert. line			
Sum WT =	1,286	MR =	1,692	Sum F =	500	MOT =	833

Friction Force	=	514 Lb	F.O.S. Sliding	= RF / F =	1.78
Passive Pressure	=	375 Lb	F.O.S. Overturn.	= MR / MOT =	2.03
Cohesion	=	0 Lb			
Resist. Force, Sum RF	=	889 Lb	Coef. Vert. Surcharge or Line Load to Horiz. = EFP / Soil Dens. =		0.333

Resultant Loc From Toe,	X = (MR - MOT) / Sum WT	=	0.67 ft.
Eccentricity From Ftg. C.L.,	e = (B / 2) - X	=	0.50 ft.
Soil Pressure @ Toe	= (2 * WT) / (3 * X)	=	1,283 psf.
Soil Pressure @ Heel	=	=	0 psf.

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DETAILED DESIGN REPORT
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STEM DESIGN: Steel Design Comb = 1.2D + 1.6L + 1.6H + 0.5R
Shr Strength @ Base, Phi Vn = 4.95 kip

Dist From Top (ft)	d (in.)	Mu (ft-k)	Vu (kip)	As Flex. (in^2)	As Min. (in^2)	As T+S (in^2)	As Reqd (in^2)	Comb
0.40	5.50	0.00	0.01	0.000	0.000	0.115	0.115	2
0.80	5.50	0.01	0.02	0.000	0.000	0.115	0.115	2
1.20	5.50	0.02	0.05	0.001	0.001	0.115	0.115	2
1.60	5.50	0.04	0.08	0.002	0.002	0.115	0.115	2
2.00	5.50	0.09	0.13	0.003	0.005	0.115	0.115	2
2.40	5.50	0.15	0.18	0.006	0.008	0.115	0.115	2
2.80	5.50	0.23	0.25	0.009	0.013	0.115	0.115	2
3.20	5.50	0.35	0.33	0.014	0.019	0.115	0.115	2
3.60	5.50	0.50	0.41	0.020	0.027	0.115	0.115	2
4.00	5.50	0.68	0.51	0.028	0.037	0.126	0.126	2

Vertical Stem Reinforcement:
Shear-Friction Steel Added at Stem Base (ACI 08 11.6), Avf = 0.011 in^2
Available Length for Hook Embedment into Footing = 9.00 in.
Available Length for Straight Embedment into Stem = 46.00 in.

#4 @ 18" o/c

	Development Length Straight (in.)	Hook (in.)	Percent Develop.	Spac. (in.)	50% Cut Off (in.)
#4	14.40	8.40	100.00	18.00	48.00
#5	18.00	10.50	85.71	18.00	48.00
#6	21.60	12.60	71.43	18.00	48.00
#7	31.50	14.70	61.22	18.00	48.00
#8	36.00	16.80	53.57	18.00	48.00
#9	45.81	18.95	47.49	18.00	48.00
#10	58.06	21.34	42.18	18.00	48.00
#11	71.57	23.69	37.99	18.00	48.00

Horizontal Stem Reinforcement:
Area of steel for Shrinkage and Temp. Reinforcement = 0.192 in^2

#4 @ 12" o/c

	-----Spacing, in.----- I.F. Only	EA. Face	------Total Bars------ I.F. Only	EA. Face
#4	12.50	18.00	5.00	4.00
#5	18.00	18.00	4.00	4.00
#6	18.00	18.00	4.00	4.00
#7	18.00	18.00	4.00	4.00
#8	18.00	18.00	4.00	4.00
#9	18.00	18.00	4.00	4.00
#10	18.00	18.00	4.00	4.00
#11	18.00	18.00	4.00	4.00

TOE DESIGN:

* Steel Design Comb. = 0.9D + 1.6W + 1.6H
* Thickness Design Comb. = 1.4D + 1.4H
* Available Length for Hook Embedment into Stem = 6.00 in.
* Available Length for Straight Embed. into Toe = 6.04 in.

d (in.)	Mu (ft-k)	Vu (kip)	Phi Vn (kip)	As Flex. (in^2)	As Min. (in^2)	As T+S (in^2)	As Req'd (in^2)
8.50	0.53	0.00	7.65	0.014	0.019	0.259	0.259

	Development Length Straight (in.)	Hook (in.)	Percent Develop.	Spac. (in.)
#4	14.40	8.40	41.94	3.88
#5	18.00	10.50	33.56	4.82
#6	21.60	12.60	27.96	5.70
#7	31.50	14.70	19.17	5.33
#8	36.00	16.80	16.78	6.14
#9	40.61	18.95	14.87	6.89
#10	45.72	21.34	13.21	7.77
#11	51.12	23.69	11.81	8.53

HEEL DESIGN:

* Steel Design Comb. = 1.4D + 1.4H
* Thickness Design Comb. = 1.2D + 1.6L + 1.6H + 0.5R
* Available Length for Straight Embedment into Toe = 14.04 in.
* Available Length for Straight Embedment into Heel = 10.00 in.

d (in.)	Mu (ft-k)	Vu (kip)	Phi Vn (kip)	As Flex. (in^2)	As Min. (in^2)	As T+S (in^2)	As Req'd (in^2)
9.50	0.39	0.75	8.55	0.009	0.012	0.259	0.259

	Development Length Straight (in.)	Hook (in.)	Percent Develop.	Spac. (in.)
#4	14.40	8.40	69.44	6.43
#5	18.00	10.50	55.56	7.97
#6	21.60	12.60	46.30	9.43
#7	31.50	14.70	31.75	8.82
#8	36.00	16.80	27.78	10.16
#9	45.81	18.95	21.83	10.11
#10	58.06	21.34	17.22	10.13
#11	71.57	23.69	13.97	10.09

#4 @ 9" o/c

LONGITUDINAL FOOTING REINFORCEMENT (TEMP & SHRINK ONLY):

	Spacing (in.)
#4	9.26
#5	14.35
#6	20.37
#7	27.78
#8	36.57
#9	46.30
#10	58.80
#11	72.22